

DOMINION ARTILLERY ASSOCIATION.

ESSAY.

HONORABLE MENTION.

ON THE SUPPLY, CARE, AND REPAIR OF ARTILLERY MATERIAL,
INCLUDING SMALL ARMS AND AMMUNITION FOR
CANADIAN MILITIA.

BY

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JULY, 1877.



QUEBEC:

PRINTED AT THE GUNNERY SCHOOL PRESS, CITADEL, QUEBEC.

1877.

EXTRACT

FROM

GENERAL ORDERS, 23RD MARCH, 1877.

DOMINION ARTILLERY ASSOCIATION.

MEDAL FOR ESSAY.

His Excellency the Earl of Dufferin, K. P., &c., Governor-General of Canada, has been graciously pleased to express his intention of offering a medal for the best essay on the Supply, Care and Repair of Artillery material, including Small Arms and Ammunition for Canadian Militia, to be competed for by Officers of the Canadian Militia Artillery, being members of, or belonging to corps affiliated with the Dominion Artillery Association. Officers or others who have served in the Royal, or Royal Marine Artillery to be excluded from competition.

The essays to be distinguished only by a motto, not that of any Artillery corps, and the manuscript not to be in the handwriting of the competitors.

The essays to be sent to the President of Council, Dominion Artillery Association, Quebec, before the last day of July, 1877.

The judges to be Officers of the Royal Artillery, viz:

The Inspectors of Artillery, and the Professor of Artillery, Military College, Kingston.

The essays may be in English or French, subject matter will be considered of more importance than style. Quotations and extracts from works bearing on the subject, may be freely made use of, but the names of the authors so quoted must be given in foot or marginal note.

The best essay will be printed at the expense of the Dominion Artillery Association, and distributed to members.

PREFACE.

With a view to enlist the sympathies of those who will favor this essay with a perusal, and commend it to their gentle criticism; I may perhaps be allowed to explain that having received my Artillery education, in English, from Lt.-Col. Strange, R. A., at the Quebec Gunnery School; I preferred writing in that language, though French is my mother tongue.

This will, I trust, explain any shortcomings.

O. PREVOST, CAPT. AND ADJT.,
Quebec Gunnery School.

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SUPPLY, CARE AND REPAIR OF ARTILLERY MATERIAL,
INCLUDING SMALL ARMS AND SMALL ARM AMMU-
NITION FOR THE CANADIAN MILITIA.

"*Vae victis.*"

The importance of the subject can not be overrated.

The fighting power of an army is, to a great extent, affected by any deficiency in armament or equipment, and they should be kept up to a proper standard, as regards both quantity and quality.

The supply, care and repair of war material, important to all arms is particularly so to Artillery.

"Although Cavalry and Infantry may by dash and bravery make up in some measure for faulty organization and inferior equipment, such is not the case with respect to Artillery; everything depends upon the armament and equipment of the latter being in good order and skilfully employed." (1)

Inferiority in armament and equipment therefore means, for Artillery, inferiority in efficiency. Numerous instances in the history of modern warfare prove the truth of this.

Other elements undoubtedly combine to make a superiority in that respect, more telling upon an adversary, but efficient armament is a condition *sine qua non* to the successful employment of Artillery.

Economy in the outlay required for a proper armament and equipment is most false and can only lead to disaster. (2)

Austria in 1859 lost the richest and most populous provinces she possessed in Italy mainly through the inferior armament of her Artillery. (3)

(1) Owen, Modern Artillery, 2nd edition, page 388.

(2) Duerot, Defence de Paris. Prevost, Forteresses Francaises pendant la Guerre, 70-71. Strange, Artillery Retrospect.

(3) Comte de Bazancourt, Campagne d'Italie.

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The English navy in 1812 was unsuccessful against American vessels, in a great measure because the broadside guns of the latter were heavier. (1)

I.

Section 1.—What armament and equipment should be supplied to the Canadian Militia.

To determine the armament and equipment required by the Canadian Militia, several considerations would govern, one of which would obviously refer to the conditions of the service which that organization would be called upon to perform.

Different contingencies may affect the case of an attack on Canada. The past indicates that an attack may be directed from a neighbouring State. It may also be made by a distant power, with a distinct object of conquest, or only to assist, by a powerful diversion, some military operation carried on in an other theatre of war. It was principally with that object, that assistance was given by the French to the American colonies in 1775. (2)

The attack may be formidable, requiring all the able bodied men of the Dominion to meet it, or it may be local calling into action a local force on a particular point of our inland or maritime boundaries.

It is however obvious that no scheme of defence can be efficient that does not meet all the above contingencies in the best possible way, and that whatever might be decided upon no scheme of defence would be practical that did not answer satisfactorily to the query.—
How would it work in war?

On reference to the history of the country it appears that both naval (by naval, attacks on inland waters as well as maritime attacks are meant), and land attacks have either simultaneously or singly been directed against its possessors, previous to and after its conquest from the French.

Past events therefore point out the necessity of providing for a successful defence; powerful armaments for our fortresses situated on inland waters and sea coasts, and a proper armament for our own naval and field forces.

(1) Sir James Carmichael Smyth, *Precis of the Wars in Canada*. Garneau, *Histoire du Canada*. Christy, *History of Canada*.
(2) Christy, *History of Canada*. Sir J. C. Smyth cited.

The war *matériel* to be supplied to the Canadian Militia must then comprise all the different equipments and armaments adopted by great military powers, in a degree of course suitable to the requirements of the case.

Thus, heavy ordnance for fortresses, forts and gun boats, siege guns for the attack and defence of fortified posts, camps, lines of entrenchments, &c.; heavy and light field ordnance for the armies intended to operate in the field; all those different natures are necessary.

Economy is also an important question with us. Expensive equipments are therefore to be avoided as far as consistent with true efficiency.

The equipment now being supplied to the British army meets all the requirements of modern warfare.

To imitate the mother country completely, is out of question. Our finances would not allow even a proportionate investment on a similar footing. But in whatever it may be deemed advisable to imitate her, we can not be guided by a better standard.

We find that taught by experience, Great Britain has provided her military establishment with an armament and equipment comprising natures of ordnance, &c., classified under the following heads:—

A, for fortresses.

B, for sieges.

C, for the field.

The reasons which have determined England to adopt the several natures of ordnance mentioned, exist also for us; the conditions of warfare not differing *essentially* in either case.

Fortresses on sea coasts and great inland waters we have to defend, and to provide therefore heavy rifled ordnance, the necessity of which is so tersely expressed in the following quotation:—"By the introduction of iron-clads the power of resistance of men-of-war has been increased to such an extent that the old guns for coast batteries, at one time so destructive against wooden ships, have now become useless." (1)

(1) Prussian Heavy Guns and the 9" Woolwich gun, by Captain Monfront, translated, Lt. D. F. Jones, R. A., Proceedings R. A. Institution, Vol. VIII.

Lighter ordnance is also required, capable of maintaining a rapid fire, suitable for repelling the landing of troops, &c., and for the defence of land fronts.

Navigable rivers—the great artery of communication and line of defence, the St. Lawrence, must be secured.

Entrenched camps and positions would have to be defended or taken, requiring heavy Artillery of position. At the Battle of Queenstown on the 11th October, 1812, "two heavy guns were placed above Queenstown commanding the river many of their boats (the Americans) were sunk by shot from those guns." (1)

Sieges of more or less importance might have to be undertaken, and also the defence of entrenchments, such as are often constructed, in modern warfare, at important strategical points.

The advantage of having efficient siege trains, has been several times made prominent by facts connected with the military history of the country. (2)

"The season and want of heavy Artillery prevented the Americans from making any impression upon the defences of Quebec." (Siege of 1775.) (3)

"Prince Menschikoff in his dispatch, partly attributes his defeat at Inkerman to the English having placed their siege Artillery in position." (4)

"La position Frahier Mont-Belliard Delle pour laquelle on ne disposait que de 48 Bataillons, 30 Escadrons, et 126 pièces de campagne, &c., — à partir du 11 Janvier on s'occupait avec la plus extrême activité de renforcer au moyen d'ouvrages, et d'y diriger une partie des *pièces de siege* de Belfort 37 bouches à feu dont 16 de 24," [about 61 pr.] (5)

The necessity of well armed Field Artillery for our defence has been so far recognized, and the Militia Field Batteries provided in consequence with the new 9 pr. M. L. R. gun and equipment.

But heavier natures of rifled ordnance are also required for medium and heavy Field Batteries. Half of the batteries of a

(1) *Precis of Wars in Canada*, cited, page 143-4.

(2) *Memoire sur les Affaires du Canada*, page 179, re-impression. Literary and Historical Society, Quebec, 1873.

(3) *Precis of Wars*, cited, page 113.

(4) *Review of the Crimean War*, page 132. Cited in *Owen's Modern Artillery*.

(5) *Campagne 1870-71, Operations des Armees Allemandes*, by W. Blume, translation by E. Costa de Serda, page 324, &c.

corps d'armée should be armed with heavy field guns and guns of position. (1)

The proportion of 3 guns per 1,000 men so strongly advocated by military writers, should be adhered to in our Militia. (2)

British Horse Artillery though provided in some cases with the same nature of gun as the light Field Batteries, have a special gun of less weight, well adapted to the exigencies of their duties in the field.

This branch of the Artillery has within a few years acquired considerable importance, specially since it has been shown in the last great war [1870], to what extent it could be used in combined action with Cavalry, for the purpose of being pushed forward with advance guards, in reconnaissances, &c. (3)

But in Canada with the present military system, a difficulty exists of providing efficient horses and riders, it is difficult to horse, even Field Artillery. (4)

And would not horse artillery be limited in its usefulness when acting in an enclosed and wooded country like Canada?

"When the allied army made its flank march round Sebastopol, the head of the column marching through an extensive and thick wood, was composed of several Field Batteries. * * * But for the halt of the army it would have touched not on the rear, but on the flank of the column [Russian,] when a few companies of infantry might with ease and impunity have destroyed great part of the Artillery." (5)

Though the introduction of the new mode of carrying gunners on axle-tree seats and by the Inspector of Artillery, Lt.-Col. T. B. Strange, of carrying gunners in the Canadian Artillery on off horses of gun teams, as also the reduction of weight consequent to the adoption of rifled guns, has done much to increase the mobility of Field Artillery, still Horse Artillery alone can possess mobility to that degree which increases so much the offensive element of an army.

(1) Owen, *Modern Artillery*, cited, pages 376 and 379.

(2) Remarks on the Proper Proportion of Men to Guns, Capt. E. Baring, R. A., page 34, Vol. VIII, R. A. Institution Proceedings. Taubert, On the Use of Field Artillery, section 3, translation by H. H. Maxwell, Lieut., R. A. Griffith's Manual, page 227. Sir G. Wolseley's Soldier's Pocket Book, page 87. Owen, *Modern Artillery*, page 373.

(3) Strange, *Artillery Retrospect*, page 39. Capt. Holist, R. A., Campaign 1870-71, German Artillery in the Battles near Metz, translation, page 68.

(4) Militia Reports 1875-76, Passim.

(5) Hamley, *Operations of War*, 3rd edition, page 447.

The difficulty of the country being enclosed and therefore limiting the bold action of horse artillery, might perhaps be met by the organization of mounted Riflemen, who would act as escort, advance guard and reconnoiterers, in which capacity they would be invaluable, the very best kind of Cavalry for a country like Canada where it could act in masses, in but a few well cleared districts, and where the greater part of the country itself and of that across the frontier, is still very wooded.

On the advantages of this special kind of Cavalry, Col. Hamley, and other military writers, lay great stress. (1)

Thus it may appear, that an armament and equipment, comprising most of the different natures of ordnance and war matériel adopted by military powers, are necessary for an efficient defence of Canada.

Section 2.—What system of guns should we adopt—

This leads to a subject much controverted.

I allude to the controversy of B. L. R., *versus* M. L. R. guns, which for years has divided the opinions of Artillerists and other scientific men.

The first system of rifled guns adopted on a large scale was that of the muzzle loader. Louis Napoleon, shortly before 1859, ordered the old bronze S. B. pieces of the French Artillery to be rifled, and he subsequently used them with great effect against the Austrians in Italy. (2)

Previous to this, however, a few 8 inch and 6½ pr. S. B. guns had been oval-bored in England and employed at the siege of Sebastopol, but with little effect it appears.

As early though as 1854, experiments had been inaugurated with breech-loading rifled guns proposed by Sir William Armstrong, which were subsequently adopted and issued to the Field Artillery, to the Navy, and also to Garrisons, a few are now in possession of the Dominion Government.

The Armstrong B. L. guns did good service during the war in China and in New Zealand. Their manufacture has notwithstanding been discontinued at the Royal Gun Factories in England, and the more simple system of M. L. ordnance adopted instead.

(1) Operations of War, 3rd edition, page 436. Soldier's Pocket Book, page 100. Strange, Artillery Retrospect, 2nd edition, page 26.

(2) De Bazancourt, Campagne d'Italie.

The following reasons were adduced in favor of the muzzle loader rifled gun by a Committee of Royal Artillery officers appointed on the 25th July, 1870:—

Simplicity of construction.

Facility of repair.

Easy working.

Rapidity of fire [not inferior to the B. L.]

Less original cost and cost of maintainance.

Less costly and complicated ammunition, which also is not so easily affected by climatic influences.

The accuracy of the M. L. is not inferior to that of the B. L. gun, whilst for the heavier nature we would have to resort to rifled M. L. in any case, as the highest B. L. R. calibre issued is the 7 in., quite inadequate for the defence of sea fronts against iron-clads, thus immediately causing complications in *matériel*, which it might be desirable to avoid.

Another disadvantage of the B. L. R. gun when used in this country, is the liability of the breech fixtures becoming for a length of time, unserviceable by frost.

An armament of muzzle loaders would therefore combine power with durability and simplicity of construction. Many reasons make those qualifications important, when supply to the Canadian Militia is in question. A complicated weapon entails complicated manœuvres, delicate handling, liability to get out of order, and skill to keep it in repair; all favorable conditions hardly to be expected with Militia men; not that they are deficient in intelligence or manual skill, but longer training than the country can afford would be necessary to obtain those points, and a number of specially qualified artificers would have to be maintained; such requisites are unobtainable with a military organization like that of Canada. (1)

For those reasons, the M. L. R. appears to be more advantageous than the B. L. R. system.

More so still, as may now be remarked incidentally, of which more hereafter, if we are not to manufacture our ordnance, but to obtain it from England, as it would not then involve there a process of manufacture special for us, and in case of co-operation with Im-

(1) Text Book, Construction of Rifled Ordnance, corrected to November, 1872, page 11. Priced Vocabulary of Stores, 1875, pages 276, 279, 303, 304, 305, &c.

perial troops, gun boats, &c., a contingency not to be lost sight of, the supply of ammunition would be greatly facilitated and simplified by its being similar for both imperial and colonial forces.

Section 3.—What special calibres of each nature of guns, what equipments and what proportions of them do we require?

Each nature of gun has its special calling, so to say.

Though circumstances occur, when certain natures have to be used for purposes other than those they had been designed to fulfil, physical impossibilities however, and other equally strenuous objections tend to limit that course.

No authority of weight can be adduced when treating this part of the subject, and to determine the proportions of each nature of guns and equipments required for the Militia, some insight in the plans prepared for the defence of the country would be essential—none as a matter of course having been made public, the question will then have to be considered from an abstract point of view: A, for fortresses; B, for sieges; C, for the field.

A

FORTRESSES.

1. ORDNANCE.—To arm sea fronts, no guns inferior to the 7 in. M. L. R. are laid down in the Corps Equipment; the 7 in. to pierce armour plate of 7·5 in., 9 in. to pierce armour of 9·5 in., 10 in. to pierce 11·25 in. and 12 in. guns to pierce 12·3 in. armour, at ranges of not more than 1,000 yards. (1)

For land fronts, guns of a much inferior calibre would suffice—7 in., 80 pr., 64 pr. and even 40 pr. are serviceable weapons in those situations, and sufficiently powerful to oppose ordnance that siege trains might bring to bear on land defences, though it would not always be safe to reckon in this manner, especially if railways could be made use of by an adversary, to bring heavier guns to the investing lines.

At the siege of Paris, [1870], the largest guns used were of 6½ inch calibre, and at Strasburg, guns equal to a 61 pr. were brought to bear on the fortress with tolerable success, but the latter siege could hardly be taken as a standard, the artillery action of the besieged having been very weak.

(1) Griffith's Manual, page 79.

Prince Hohenlohe, (1) says, "it may be asserted that a large fortress favorably situated which has all the resources of art at its disposal and is well defended can only be captured by a regular attack, if the besieger has a Railway at disposal, because he can by its means alone provide a superiority of matériel over the enemy."

Again, "mais le transport [of siege train] ne pouvait commencer que quand Toul serait pris et que la ligne de l'Est serait ouverte," &c. (2)

So the contingency of the employment of available Railways, must be provided for, in an armament to oppose ordnance that may be brought up by them.

To determine their armament, fortresses were formerly considered as of the 1st, 2nd or 3rd class, according to the number of their bastions and sides. A more modern mode of classification is now used, consequent to the adoption of the polygonal system of fortification which develops greater power of Artillery fire, the really true defensive element of fortresses in our days.

The polygonal is now replacing the bastioned trace, comparatively so expensive and complicated, more favorable perhaps for near defence, but certainly deficient when distant defence is contemplated, as it limits the effective Artillery fire of the works.

Therefore, taking for granted that each garrison gun requires a space of 40 feet from it to the next gun on its flank, calculated from centre to centre; then, length of parapet of the three largest adjacent faces of a polygonal system of fortification likely to receive attack, divided by 40, will give the number of pieces of ordnance required, their calibre varying according to the nature of the attack they are intended to meet and the weight of metal, *i. e.*, power of projectile that might be brought against them. (3)

The Instruction in fortifications, R. M. A., Woolwich, recommends about 50 feet from gun to gun.

Very little has been done to supply our fortresses with suitable ordnance, the heaviest rifled guns provided for Quebec and Kingston

(1) Pamphlet on sieges, translated by Capt. F. C. H. Clarke, R. A., cited in Owen's *Modern Artillery*, page 465.

(2) *Operations des armées Allemandes, 1870*, translation cited page 52.

(3) Capt. A. Farnell, R. E. *Defensive Reform*, page 42, Vol. XIX, Royal Engineer Papers.

being 7 in. B. L. R., 32-64 prs., and it is believed a few 80 prs.; the latter have been ordered for St. John, New Brunswick.

Though, very serviceable guns undoubtedly they all are, still it will be granted that their lack of power to pierce armour-plate renders them, except in very favourable situations, unreliable to defend coasts where serious attacks are apprehended and approachable to iron-clads. (1)

Heavier guns mounted on Moncrieff carriages have been recommended by Lt.-Col. Strange, R. A., Dominion Inspector of Artillery, to defend the entrance of the harbour of Quebec.

With her light armament, though provided to a certain extent for defence at close quarters, Quebec is sadly deficient if distant defence of river fronts is contemplated. Quebecers know, perhaps, that distant defence means comparative safety for their homes and persons, and that it might be advantageous to have a few 9 in. or heavier guns, even at the cost of some thousand pounds, to secure this.

The above applies equally to Kingston, exposed to a naval attack that might prove too powerful for her weak armament. It may be useful to remember that gun-boats armed with 150 pr. M. L. R. guns were used during the last American Civil War against Confederate defences. (2)

The United States have recently adopted M. L. R. 8 in. guns, converted from 15 in. Rodman's, capable of piercing 8 in. armour-plate.

In choice of armament where all is relative, a safe guide to go by is to consider what can be brought against, to determine with what to oppose.

Torpedoes though in the British service exclusively in the Royal Engineer charge, will in this country it is to be hoped be intrusted to the Artillery. Our Canadian Engineer force, in any case, is so limited that this can hardly be a matter of choice.

Of the efficacy of torpedoes in coast and river defence, the American Civil War has adduced sufficient proof. Sixteen Federal steamers were blown up by them, in endeavouring to force passage in southern harbours and rivers. (3)

(1) Text-Book, Construction of Rifled Ordnance, pages 13, 14 and 140.

(2) Treatise on Coast Defences, Von Schelleha, page 141.

(3) Von Schelleha, Coast Defence, cited, chapters 17 and 19.

No battery, it has been proved, however heavily armed, is impassable to iron-clads if torpedoes and other obstructions do not delay the ships under its fire.

On the subject of torpedoes, Major-General Lewis remarks:—"No battery or batteries, however strong, can stop or prevent ships of war entering harbours, when navigation is free and the course nearly direct."

Fired by means of electricity, torpedoes become engines of destruction at once formidable and well under control, specially so when combined with an efficient mode of interpolating the exact position of the adversary.

The harbour of Quebec, offers good facilities for the employment of a torpedo system of defence in conjunction with shore batteries; the channel being narrow, indirect in its course, and well commanded from the banks of the river.

Torpedoes, combined with the use of even light guns, to prevent parties from dredging and destroying wires, &c., would be a serious obstacle to the approach of iron-clads and ensure comparative safety to harbours, dock yards, &c.

Mortars have not been mentioned with the natures of ordnance considered, rifled mortars and howitzers have now to an extent replaced them, and there is, moreover, a good supply of S. B. mortars in possession. The importance of vertical fire has increased since modes of protection from direct fire have been perfected; in a complete system of defence of a fortress, its employment can not, therefore, be discarded.

Though not laid down specially in the Corps Equipment regulations for 1873, rifled howitzers are undoubtedly to form part of future armaments, instead of mortars, to which they stand in the same relative position as rifled guns to smooth bores.

2. CARRIAGES.—Carriages and platforms are also to be considered under the head of ordnance. This involves the question of protection to armament, upon which different opinions are entertained.

Some are in favor of casemates with shields, or open batteries with shields and overhead cover to be put up on an emergency, others prefer Moncrieff carriages and platforms in pits. High authorities are favourable to the employment of both systems, each in particular situations.

The great advantage of the Moncrieff system appears to be that it is economical.

"The Committee on Moncrieff carriages, have reported that as compared with the cost of a casemated battery with shields, as estimated for a 9 in. gun of 12 tons, the balance in favour of the Moncrieff system, would be £1,800 per gun, and compared with open batteries with and without temporary splinter proof cover, the saving would be respectively £667 and £450 per gun." (1)

The extensive range obtained from each gun, by this system which allows to concentrate a greater number of guns on a particular point than any other, and the amount of cover it gives to the gun detachment are great advantages. Guns mounted in Moncrieff pits being also less conspicuous, another important object is secured.

The disadvantages of the system are; the structure being exposed to vertical fire, complication of mechanism and its liability to get rusty, less rapidity of fire than with casemate carriages and platforms, more exposure when at the firing position than with shields. (2)

Vertical fire could likely affect ordnance mounted on the Moncrieff principle, more than it would, ordnance protected by casemates, but there is as yet a large margin of error against high angle fire, even with rifled howitzers, especially if fired from ships at such high elevations as are given.

"In such positions [coast batteries] the Moncrieff method of mounting guns will be of the greatest use." (3)

For the above reasons it would therefore appear advantageous to adopt the Moncrieff system of mounting ordnance. (4)

Another mode of protecting armament by means of iron turrets has been applied to the defences of Plymouth, Antwerp and Portsmouth (5); but this mode, though efficient, is very expensive, and as it does not imply of a necessity a special system of mounting but only of protecting ordnance, it may not be further noticed.

(1) Journal of the Royal United Service Institute, Vol. XVII. No. LXXIV, page 604 and 605.

(2) Griffith's Artillerist Manual, page 76.

(3) Instructions in Fortifications. Royal Military Academy, page 207.

(4) Capt. Parnell, Professional Paper, cited. Strange, Artillery Retrospect, page 73. Brialmont, Fortification Polygonale, page 242. Fortereses Francaisses Pendant la Guerre de 1870, page 128.

(5) Brialmont, cited.

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In certain positions ground platforms and common standing carriages would suffice, not in those situations, however, where it would be necessary to fire at objects moving at a rapid rate, for then traversing gear would be required to obtain rapidity and accuracy.

On land fronts, for instance, common standing carriages and ground platforms could in a great measure be used, as direction of fire does not vary rapidly, the guns being chiefly employed in hindering working parties during a siege, seconding sorties or protecting advanced troops or positions, acting in a manner similar to that adopted with success at Belfort in 1870, (1) or at a later period of the siege in silencing the breaching batteries.

Wood sliding carriages and dwarf traversing platforms might also be used to mount guns in salients, viz: M. L. R. 80 pr. and 7 in. B. L. R., [those now in possession]. Iron carriages and platforms would be required for guns of over 6 tons.

In those situations on sea fronts sufficiently elevated to give, *ipso facto*, protection to gun detachments and matériel, the latter description of carriages and platforms [iron] to mount heavy guns *en barbette* might be used.

Ordnance, at all events, should be disposed so as to do away with embrasures which are funnels for the enemy's shell. "Elles forment d'excellentes cibles pour l'artillerie de l'assiégeant." (2)

High angle fire and curved fire seem to have given at Paris and at Belfort, fair results for the besiegers and the besieged, giving opportunities of keeping personnel and matériel well under cover. (3)

Les pièces retournées tirant sans voir, étonnèrent fort les Prussiens qui recevaient nos projectiles sans savoir où diriger leurs coups." (4)

"Nous préférons également l'usage des pièces masquées à tir plongeant dont la garnison de Belfort a tant à eu se louer." (5)

Screens of shrubs or of other material when applicable, could also be used with advantage when firing *en barbette*, though a prolonged fire would destroy them. (6)

(1) Siege de Belfort, D'Entfert Rochereau, page 100.

(2) Forteresses Françaises, cited, page 120. Artillery Retrospect, page 57.

(3) Artillery Retrospect, page 57.

(4) Defense de Belfort, page 168.

(5) Forteresses Françaises, cited, page 127.

(6) Brialmont, Fortifications Polygonal, pages 252 and 253.

This and a few spare platforms enabling the defenders to change the positions of their pieces, would perhaps be efficient.

Siege and travelling carriages would be required to mount 40 pr. guns in the proportion of $\frac{1}{3}$ of the whole armament. Spare carriages in the proportion of $\frac{1}{3}$ to $\frac{1}{4}$ of the total number of guns would also have to be provided, as a great number of carriages are likely to be rendered unserviceable during a siege. (1)

Moncrieff carriages are by no means to be confined to sea coast batteries, they are useful to mount heavy calibres for the defence of land fronts, as barbettes are exposed to artillery and musketry fire, even at the earlier period of a siege. Emplacements could easily be disposed for them on the ramparts. This mode of mounting ordnance, expensive at first, protects so efficiently both matériel and personnel that it may in course of time be found the most economical mode to adopt.

Under the head of carriages shall be mentioned platform wagons, sling wagons, drags, dillies, trench carts, transporting axletrees and wheels.

Sling wagons [iron,] heavy, are required to transport heavy guns, viz., up to 12 ton; they are issued in the proportion of one per district.

Sling wagons [wood] service, are available for transporting guns of 6 ton, if with wrought-iron fittings, and of about $4\frac{1}{2}$ ton if with cast iron fittings.

Heavy wood sling wagons can move guns of from 12 to 25 tons.

Light wrought-iron sling wagons carry 7 tons. The detail of stores issued with sling wagons complete is given at page 25, &c., Corps Equipment, part I, 1873.

Platform wagons can carry about 5 tons, their principal use would be in transporting converted and S. B. ordnance and common carriages.

Drags are intended for confined localities where sling wagons could not be used; they are capable of moving the heaviest ordnance.

Sleighs are also specially provided, but as they can easily be improvised with such materials as skids, scotches, lashing, &c., they need not be considered here.

(1) Owen, Modern Artillery, page 500.

Dillies may be useful to transport dwarf traversing platforms, such as are used with 7 in. B. L. R., heavy S. B. or converted guns.

Axle-trees, square, with wheels, are issued for 13 in., 12 in., 10 in., 9 in. and 7 in. M. L. R. guns, in the proportion of 1 per district, they are used for moving gun carriages and platforms.

Axle-trees, round, with wheels, are supplied with B. L. R. equipments available for S. B. and converted ordnance. (1)

Appliances for mounting ordnance, such as sheers, cranes, gins, skids, levers, hydraulic jacks, would be required with a variety of tackle, rope, &c., from the iron chain of 27 ton proof strain to the light drag rope of 1 inch; from the whip of a working strain of one ton, to the heavy Bothway capable of sustaining a strain of 18 ton.

Special stores are laid down for landing, mounting, and dismounting guns of 23 and 25 tons. (2)

Other stores for working guns would have to be provided, viz., shell bearers, bits vent, buckets, drifts, handspikes, lanyards, rammers, sponges, wad hooks, &c., all for the service of heavy muzzle loading ordnance. (3)

Magazine stores would also have to be provided.

3. AMMUNITION.—The term ammunition is comprehensive in its meaning, it includes not only charges of powder and projectiles used with the different natures of ordnance, but embraces also tubes and other means of firing charges.

PROJECTILES.—The projectiles used with heavy natures of M., L. R. ordnance, viz., 12.5 in., 12 in., 10 in., 9 in., 7 in., consist of Shrapnel; common, Palliser shell, and Palliser shot, cored; in addition, the 7 in. M. L. R. is provided with a double shell, the 9 in. and 7 in. with case shot.

The detail of 100 rounds for the 12.5 in., 12 in. and 10 in. guns, is:—

Common shell.....	26
Palliser "	36
Shrapnel "	3
Palliser " cored.....	35

100

(1) Corps Equipment, page 6.

(2) W. O. Circular, 15 [N. S.,] para.

(3) Corps Equipment, pages 1, 2, 3 and passim, part 2, section I.

Those guns being intended for sea fronts are mostly provided with hard metal [Palliser] projectiles, to pierce armour plate.

The detail of 100 rounds for the 9 in. M. L. R. is:—

Common shell.....	30
Palliser ".....	32
" " cored.....	32
Case shot.....	3
Shrapnel ".....	3
	100

For the 7 in. M. L. R. :—

Common shell.....	25
Double ".....	5

The remainder of the 100 rounds in similar proportion to those of the 9 in. gun. (1)

The detail for the 80 pr. and 64 pr. M. L. R. per 100 round, and also for the 7 in. and 40 pr. B. L. R., is:—

Common shell.....	60
Segment " }.....	30
Or Shrapnel " }	
Case shot.....	10
	100

No Palliser shot or shell is provided for the 80 and 64 pr. guns, as though at first intended to be battering guns they were subsequently relinquished for that purpose; (2) in experiments at Shoeburyness they have, however, proved sufficiently powerful to penetrate iron-clads of the Warrior class.

"The number of rounds per gun must obviously vary, as the quantity of ammunition for the defence of a fortress is regulated by its extent, and also by the probable duration of the siege it may have to sustain."

(1) Corps Equipment, 1873, pages 1 and 18.

(2) Text Book, Construction Rifle Ordnance, page 140.

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"It is generally considered that in ordinary fortresses no more ammunition should be stored than that necessary for a vigorous defence." (1)

The number of rounds for land fronts for 7 in., 64 pr. and 40 pr., is 200 rounds when in fortresses abroad. (2)

Capt. Parnell in his paper on "Defensive reform" recommends, in forts, 300 rounds per heavy gun, and for supplementary pieces 75 rounds per gun; in fortresses, 400 rounds per heavy gun, and for supplementary pieces 100 rounds per gun. But as about $\frac{2}{3}$ only of the pieces would be used at the same time, the proportion would be over 500 rounds per gun actually engaged.

This and the practice carried on in France concur. General Ducrot says: "Les munitions étaient en petite quantité au début du siège. Les gros calibres étaient à peine à 200 coups par pièce, au lieu de l'être à 500." (3)

A large number of rounds in store per gun, was however of less importance in Paris than it might have been in other fortresses, as private enterprise could supply any deficiency. "Le comité de la défense fit appel à l'industrie privée; dès la fin de Septembre, la fabrication des obus était en pleine activité." (4)

Therefore the duty of the officer commanding the Artillery of a fortress, might be to ascertain the resources of private industry before requisitioning for an excessive quantity of projectiles, &c.

POWDER.—The powder used in the British service, for the battering charges of heavy guns, is Pellet or Pebble, and also for the service charges of the 12.5 in. 12 in. and 10 in. guns.

Though Rifle L. G., and even L. G., is used for 9 in. and lighter calibres of Woolwich guns, when circumstances render it necessary, still, "officers to whom the issue [of Service L. G.] is made are to be informed of the circumstance and they will take steps to have the guns with which such ammunition is issued, examined if possible after every 25th round." (5)

It may during an action not be possible to carry out this recom-

(1) Corps Equipment, section I.

(2) Owen, Modern Artillery, page 507.

(3) Defense de Paris, page 156.

(4) Ducrot—Defense de Paris, page 156.

(5) Notes on Ammunition, part II, 1870, page 121.

mentation which [if made with purpose,] it might be advantageous to arrange, not to have to comply with, by the issue of proper powder.

Shell L. G. is used to fill up common and Palliser shell, as well as cored shot; and pistol powder, to fill up shrapnel shell.

Special proportions to each gun for those various purposes are laid down in the Lists of Ordnance, &c., to which reference is made.

An average proportion of thirty pounds of powder, per round for all calibres is suggested in the paper on "Defensive Reform," cited above; a fair average considering the comparatively small charges of the 40 pr. and lighter guns of the defence.

LABORATORY STORES.—Fuzes, tubes, portfires and other means of igniting charges come under this head.

Of fuzes for M. L. R. Ordnance, there are two natures: time and percussion.

The general proportion of time fuzes for heavy calibres is, one 9 second fuze per shrapnel, and ten per cent. spare, and one 20 sec. or 9 sec. fuze to every four common and double shell, the number of 9 sec. fuzes being twice that of the other. The proportion of percussion fuzes is, one Pettman G. S. [or Royal Laboratory] fuze per common and double shell. (1)

For 80 and 64 prs., the proportions of fuzes per hundred rounds are:

Percussion Royal Laboratory	60
Time..... 20 second.....	25
" 9 "	50
" 5 "	25 (2)

For B. L. R. guns on land fronts and flanks one 9 sec. time fuze per Shrapnel and ten per cent. spare, one 20 sec. or 9 sec. fuze per common or segment shell and ten per cent. spare; the number of 9 sec. fuzes being double that of the other.

Tubes, friction, are issued, one per round and twenty per cent. spare for all natures. As to portfires and slow match 4 port fires and 1 lb. of quick match per hundred rounds are laid down for all natures. (3)

(1) See note, Corps Equipment, page 2.
(2) Owen's Modern Artillery, page 508.
(3) Corps Equipment, cited.

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The old patterns of ground and parachute light balls for S. B. ordnance are not yet replaced except by a star shell, with which the 7 pr. M. L. R. gun equipment is provided and by an electric light apparatus, of which only one sample exists, it appears.

The importance of discovering an enemy's working parties at night, can not be overrated in the defence of a fortress.

"L'ouverture des premiers travaux contre Bellevue, donnait à penser que d'autres allaient suivre et il fallait se préoccuper des moyens d'éclairer, la nuit, les travailleurs ennemis. (1)

"The importance of establishing a good system of lighting up channels and water approaches..... By means of their calcium lights the Federals were enabled to continue even during dark nights, the bombardment of Fort Sumter and Battery Wagner, rendering communication with these points an undertaking not without danger." (2)

"We of the services, are morally bound to employ any agency which will be effective in prolonging a defence or shortening an attack, and in the Magneto Electric light we have a weapon we shall be compelled to adopt." (3)

Incendiary projectiles have not yet been adopted for rifled guns. Carcasses and Martin shells are the only incendiary projectiles in the service. Petroleum has been used to spread flame, but its local action is less powerful than that of carcass composition. (4)

There is on hand a supply of shot furnaces that might be made available on an emergency, but no cupolas for melting iron, it is believed, are in possession. In fact no incendiary projectiles, proper, are in store in Canada.

Telegraph lines and apparatus, though for what reason it is hard to say, are not considered as appertaining to the Artillery, by their usefulness to combine the action of ordnance in a system of defence as now adopted, comprising detached forts and batteries distant from each other, but which may, however, effectually in certain circumstances concentrate their fire, would be an important

(1) *Defense de Belfort*, page 147, cited.

(2) *Treatise on Coast Defence*, page 318, cited.

(3) Capt. W. de W. Abney, R. E., page 314, Vol. XX, No. 84, *Journal U. Serv. Inst.*, 1876.

(4) *Short Notes on Field Batteries*, Capt. C. Orde Brown, part II, page 64.

adjunct to the armament of a fortress, and may as such be treated as part of the Artillery material to be supplied.

The reasons given in the *Soldiers Pocket Book*, page 258, for the employment of telegraphic communication in the defence of rivers, exist also for the defence of a fortress. The above work, page 261, recommends also telegraph lines to facilitate siege operations.

Telegraphic communication was used with advantage at Belfort [1870], by its defenders.

"Le réseau télégraphique fut augmenté de nouveau postes, aux Deux Perches, à Bellevue, au Faubourg de France et au camp retranché permanent." (1)

"Sur des points choisis, on établissait [the Prussians round Paris] des observatoires dont les plus importants étaient télégraphiquement reliés entre eux, et avec les quartiers-généraux." (2)

B

SIEGES.

For siege trains the ordnance laid down ³ (3) is as follows:—

55.....	64 pr. guns.
20.....	40 " "
30.....	8 in. howitzers.

The number of pieces in a siege train is arbitrary, and a proportion of each nature would have to be fixed in accordance with the above scale to suit requirements. Obviously if a line of railway or navigation could be used to bring still heavier ordnance to lines of investment, it would be most advantageous to do so.

"It may be asserted that a large fortress favourably situated, which has all the resources of art at its disposal, and is well defended, can only be captured by regular attack if the besieger has a railway at disposal, because he can by its means alone, provide a superiority of material over the enemy." (3)⁴

(1) *Defense de Belfort*, cited.

(2) *Operations des Armées Allemandes*, W. Blume, page 60. Translation cited.

(3) *Owen's Modern Artillery*, 2nd edition, page 461.

(4) *Prince Hohenlohe, A Pamphlet on Sieges*, translated by Capt. F. C. H. Clark, R. A., cited in *Owen's Modern Artillery*, page 465.

In 1859, in addition to Field Artillery, 200 guns and 70 mortars were provided by the French, for the siege of Italian fortresses—each piece supplied with an average of 900 rounds of ammunition. (1)

But assuming that ordinary roads and horse traction are to be used, and none other, then the above descriptions and proportions of ordnance may be considered as meeting requirements satisfactorily.

The question of siege trains is generally treated under three heads: *Personnel, matériel and transport*. The two last only are within our province, and under them, the proportions and descriptions of ordnance and ammunition, as also of the different carriages, harness and equipments.

1. **ORDNANCE.**—Siege trains as laid down in the Corps Equipment, 1873, consisted of breech-loading guns, viz., 7 in. of 7½ cwt., 64 prs. of 61 cwt., and 40 prs. of 35 or 32 cwt. Breech-loaders have, it appears, now been replaced by muzzle loaders, and rifled howitzers added to the equipment instead of the S. B. mortars formerly provided.

The 7 inch B. L. R. shell has greater capacity than that of the 64 pr. M. L., an advantage that Major General Lefroy points out (2) as important; the 7 inch shell containing 7 lbs. 10 oz., and the 64 pr. shell only 7 lbs. 2 oz.; but this it seems, is compensated by the lighter weight of the 64 pr., and in our case, by similarity being secured with the armament previously indicated for fortresses, thus rendering the same ordnance available for either purpose, garrison or siege, and simplifying our material.

The 40 pr. M. L. R. shell has more capacity than that of the 40 pr. B. L. R. for which it is substituted, the former containing a bursting charge of 2 lbs. 10 oz., the latter only 2 lbs. 4 oz., the adoption of the 40 pr. M. L. gun securing moreover a similarity to the armament of fortresses, previously determined, with the same advantages as above mentioned.

The 8 inch Rifled howitzer is superior to the S. B. 10 in. mortar which it has replaced, for both accuracy and weight of projectile, the latter an important point with vertical [high angle] fire, the weight of the 10 in. mortar shell, standing to the other in a relative propor-

(1) Hamley, Operations of War, 3rd edition, page 10.

(2) Hand Book for Field Service, page 112.

tion of 87 lbs. 2 oz. to 167 lbs. and its bursting charge as 5 lbs. 4 oz. to 14 lbs. 9 oz.

The howitzer is, however, heavier than the 10 in. mortar of 18 cwt.

In the absence of more modern incendiary projectiles, and illuminating appliances, a proportion of the lighter natures of mortars could be utilized to project light balls, &c., they would be transported on trench carts or in G. S. wagons.

2. CARRIAGES.—This leads us to consider what carriages would be required to transport the siege ordnance and ammunition, and in what proportions.

They would be as follows :

64 pr. M. L. R. gun carriage.....	} One per piece and one spare to every 7 carriages.
“ “ “ “ limber.....	
40 pr. M. L. R. gun carriage.....	
“ “ “ “ limber.....	
8 inch howitzer carriage	} 7 carriages.
“ “ “ “ limber.....	

General service wagons N. P., platform wagons, sling wagons, trench carts, siege wagons and hand carts, as follows :—

Wagons.	{ General service.....	1 per two pieces of ordnance.
	{ Forge	
	{ Store	1 per ten “ “

For the remainder, proportions are laid down in Lefroy's Hand-book. (1)

Clerk's and ground platforms would also be required, as well as gyny, skidding, tackle of all sorts to mount ordnance, &c. Gyny are not desirable in a siege train; they are too conspicuous when in use and can be replaced with advantage by skids, &c. G. S. wagons, trench and hand carts are used to carry stores of all kinds, the former, ammunition principally, for which service they are specially fitted up.

The gun carriages for the 64 pr. M. L. R. are of wood or iron. Carriages, 18 pr., have been converted to suit the 40 pr. B. L. R., but not the 40 pr. M. L. R. gun.

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When issued to volunteers in England, the 40 pr. carriages are fitted with shafts for farmers draught.

The new carriages for siege trains are all of wrought iron, the 40 pr. M. L. R. carriage being similar in construction to that of the 9 pr. M. L. R.

The system of laying the guns is different in seige batteries, to that followed in other situations; the elevation is given by means of a quadrant, and the direction, with sights which permit of the gun being laid from under cover. (1)

The Rifled Howitzer carriage, is constructed to allow the piece being fired both on or off wheels.

The great advantage of wrought-iron carriages is their durability and power of resisting shocks of discharge and strains when traveling on rough roads, &c. They also do not deteriorate like wooden carriages which are liable to decay even when kept in store, well protected. Iron carriages are, however, expensive and on service may perhaps not be so easily repaired as wooden carriages.

The limbers for the 64 pr. and 40 pr. carriages are fitted for four horse draught, and might be arranged, it is thought, to allow the use of farmers harness in connection with them, though it would be an advantage to have an organized *personnel* and *materiel* for the transport of a siege train.

The limber of the 40 pr. can be used with the 8 in. howitzer carriage.

It would probably be found practicable to utilize part of the supplementary armament and equipment mentioned under the head of Garrison in the organization of a siege train. On several occasions siege trains have been supplemented by makeshifts of this nature. In the Crimea, broadside guns from shipping were mounted in breaching batteries.

Certain means of transport must however be specially provided. Railways and water routes may help to bring siege equipment and stores, more or less in proximity to points where they would be required, but transport on ordinary roads would often be unavoidable. The German operations around Paris were much delayed in consequence of a want of means to carry on this service, not through neglect, however, of providing ample means of transport, but the

(1) List of changes in war materiel, 1st April, 1877.—sec. 3070.

advance had been so rapid and available railways so blocked up with food and other stores, that transport trains could not be forwarded, and the besiegers had to have recourse to such means as the country afforded.

Thus to bring ammunition, &c., from the nearest railroad station to the parks it took vehicles eight days to go and come back. Horses were inferior and the carts of the peasantry not of the proper kind for the transport of Artillery matériel. (1)

Special vehicles are required to convey guns and ammunition, the latter easily deteriorates if not properly packed and secured. Sling wagons, service wagons, &c., are essential in fortresses, and at least a part thereof could be utilized in connection with the siege train if circumstances required it.

At present a very limited supply of transport material of any kind exists in this country and it could not be improvised. Ordinary vehicles may be used to cart provisions, &c., but for the transport of heavy ammunition and Artillery stores through rough and broken roads, none but the strongest description of vehicles can resist, such as are not used generally by civilians.

3. AMMUNITION.—The ammunition required for siege trains has been fixed at 500 rounds per gun. (2)

The proportions of projectiles for the different calibres with ~~weights~~, would be as follows:—

Case shot	10 per cent.
Common shell.....	60 " "
Shrapnel shell.....	30 " "

The proportions of illuminating and incendiary projectiles with mortars, would be:—

Light balls.....	5 per cent.
Carcasses.....	5 " "

The quantities of powder required, per round, for the natures of ordnance mentioned, are laid down in Lists of Ordnance, &c., to which reference is made.

(1) Blume, cited, page 54. Owen's Modern Artillery. pages 466 and 467.
(2) Owen's Modern Artillery, page 462.

The proportions of laboratory and miscellaneous stores are as laid down in the *Hand-Book for Field Service*, page 458. 1874 edition.

C

FIELD.

Batteries of Position in the British Service are armed with 40 pr. and 25 pr. M. L. R. guns. (1)

The essentials of guns of Position being weight of projectile and long range, consequently large calibre and increased weight of the gun, mobility has been sacrificed to a certain extent; as they are not so intimately connected with the other arms as lighter guns, their movements may be slower and they can occupy positions for a longer time, being from their more extensive range, less liable to be disturbed by the fluctuations of the fighting line.

Taubert assigns to Artillery of Position, three duties:

1st. Support to the Artillery of division in combat, by detaching single batteries from the reserves.

2nd. To defend and attack in defile actions, in the passage of rivers, in local engagements and entrenched positions, with the special task of engaging the enemy's artillery therein.

3rd. To form masses of Artillery for the decisive struggle of the action, both in an offensive and a defensive sense.

The 40 pr. M. L. R. gun, as a gun of position is well adapted to fulfill these requirements. Its large shell capacity ensures its efficiency for breaching field works of the strongest profile, while its long range and heavy projectile, enables it to engage the enemy's artillery, with success.

Instances of the advantageous employment of heavy Artillery against lighter guns are given in Owen's *Modern Artillery*. (2) "These light guns, [9 pr. guns and 24 pr. howitzers], being unequally matched against the heavy Russian pieces, Lord Raglan ordered up two 18 prs., which were brought into action by Lt.-Col. Dickson, R. A."

"Totleben remarked that they [18 prs.] acted with much success till the end of the battle."

(1) Owen's *Modern Artillery*, page 379. Griffiths Manual, page 68.

(2) Page 411-415.

The 25 pr. guns have recently been adopted in the British Service, they are intermediate to the 16 pr. and 40 pr., their weight is to that of the 40 pr. as 18 cwt. to 35 cwt.; they have thus, greater mobility and can bring more ammunition into action; their shell being at the same time sufficiently effective to breach strong entrenchments. With this and other guns, Picric powder could be substituted for the ordinary bursting charge of shell L. G. powder increasing much the breaching power of their shell. (1)

A much less powerful gun, the 20 pr. B. L. R., penetrates an artificial parapet of very compact loam, thirteen feet in thickness, at over a thousand yards range.

Therefore, 40 pr. guns can be put to a threefold use; as supplementary guns in fortresses, as light guns of a siege train, as heavy guns of position in the field; they are, in fact, most useful weapons in the service, and as their equipment might be selected so as to adapt them to all three purposes; they could be procured in sufficient numbers for one and be utilized in either or both of the other purposes as circumstances required, without further outlay.

The 25 pr., by its mobility, would be particularly well adapted to support divisional Artillery in combat, its lighter weight allowing it to be brought in situations where 40 prs. could be placed with difficulty, delaying timely support that often secures success. "In this action [Marengo] the twelve pieces [reserve] of Boudet's division, which had only just arrived, checked the victorious career of the Austrians by their unexpected and efficient fire." (2)

The capacity of the 25 pr. equipment to carry a relatively large quantity of ammunition, qualifies it to sustain a prolonged Artillery action.

The American 20 pr. Parrot, the nearest equivalent to the 25 pr. on this side of the Atlantic, is lighter by a little over 2 cwt., but its shell capacity is inferior as also its range.

British *Field Artillery* is divided into *heavy* and *light*; *Horse Artillery* being considered to a certain extent as distinct.

1. ORDNANCE.—The heavy batteries are armed with the 16 pr. M. L. R., the light batteries with the 9 pr. M. L. R., of 8 cwt., and the Horse Artillery with 9 pr. M. L. R. guns of 8 cwt. and 6 cwt.

(1) Short Notes on Field Batteries, part II, page 8.

(2) Taubert. Use of Field Artillery, translation, page 134.

The 16 pr. has replaced the 12 pr. B. L. R., which was found inefficient against earthworks, its shell having a capacity of only 8 oz.

Two calibres of 16 prs. were experimented upon, one of 3·3 inch and another of 3·6 inch, the latter was adopted; it weighs 12 cwt.

Two natures of 9 pr. M. L. R. have been issued for field service, one of 8 cwt. and the other of 6 cwt. They were substituted for the 9 pr. B. L. R., to which they were declared superior, by a committee of Royal Artillery officers, after thorough experimenting. (1)

Though British field guns are generally heavier than those of foreign armies, still their superior range and high initial velocity [which gives a flat trajectory, therefore more hitting opportunities,] compensate for this disadvantage. The 9 pr. of 8 cwt. has an initial velocity of 1,380 feet, that of the Prussian 4 pr. [corresponding to the 9 pr.,] is of 1,210 feet, and their range at 12° of elevation is 3,605 yards for the former, and 3,507 yards for the latter. (2)

The 9 pr. compares also favourably with the American 10 pr. Parrot weighing 8 cwt. which though projecting a heavier shell is at a manifest disadvantage at such a useful range as 1500 yards, which is obtained with the British gun firing at three degrees of elevation, while the 10 pr. Parrot requires nearly four degrees, the flatter trajectory of the 9 pr. securing more hits.

It therefore appears judicious to have chosen the 9 pr. M. L. R. to arm the Canadian Militia Batteries, though the lighter 9 pr. of 6 cwt., would perhaps have answered the purpose better as it is not inferior to the 9 pr. of 8 cwt. in any respect whilst an advantage would have been secured by its adoption, in facilitating thereby if found advisable, the conversion of Field Batteries into Horse Artillery Batteries armed as lightly as those of the Imperial Service. (3)

The present armament of four guns per battery is similar to the Swiss mode of armament. Why the similarity exists must be conjectured.

The British batteries are armed with 6 guns, and foreign Artilleries are provided with 6 or 8 guns per battery.

(1) Text-Book, Construction of Rifled Ordnance, page 11.

(2) Griffith's Artillerist Manual, page 81.

(3) Lt.-Col. Strange's Report dated 31st December, 1875. Appendix No. 3, Militia Reports, 1875.

With the reduced establishments authorized in the Militia, it might possibly have been difficult to man more guns than those provided.

If an increase of the number of guns was contemplated so as to bring it up to the proportion of 3 per thousand men, already mentioned; the increase might take place to an extent by simply adding two guns per battery with additional officers and gunners, thus advantageously amalgamating to a partially trained force instead of forming new batteries with an entirely untrained establishment.

The advantage of a 6 gun battery is increase of fire and easy management, with great adaptability to the rapid movements now requisite. (1)

As concentration of fire is more and more important, two batteries of 6 guns [12] under one directing head [superior officer of Artillery,] would, it may be granted, be likely to produce more effect than the same number of guns into three tactical Artillery units under subdivided command. As Artillery must be used more and more in masses, unity of command becomes therefore very desirable.

2. CARRIAGES.—The present number of carriages on the war establishment of British Field Batteries is 15, including 6 guns carriages, 6 ammunition wagons and 3 general service wagons, one of which is fitted with a forge, the first and second reserve being transferred to a divisional column. (2)

On peace footing they are reduced to:—

9 pr. Horse Artillery.	9 pr. Light F. Art'y.	16 pr. Heavy F. Art'y.
Gun carriage.....6.....	6.....	6.....
Ammunition wagon.3.....	6.....	6.....
Store cart1	1.....	1.....

General Favé (3) in a pamphlet recently published, points out the disadvantage of having considerable trains of heavily laden ammunition wagons attached *intimately*, to Field Batteries. He gives this as the principal cause of the retreat the French were obliged to inaugurate on the 16th August, 1870.

(1) Owen's Modern Artillery, page 334.

(2) Owen's Modern Artillery, page 334.

(3) L'armee Francaise depuis la guerre, page 69.

For the last two years ammunition wagons have not been horsed for drill with Militia Field Batteries. Till lately, they had been a useless encumbrance, as they were fitted for S. B. gun ammunition.

The few that are in the country have been altered to suit the rifled gun ammunition. Two per battery should be the least proportion on a peace establishment, while one per gun is required to complete the equipment, especially if of the old pattern, which when altered, would not contain all the ammunition laid down for the first line.

The mode of attaching spare wheels could possibly be improved so as to do away with the inconvenience of unlimbering to remove them from the axle-trees on the perches. A Madras pattern wheel would require to be carried as spare, instead of the O. P. wheel now provided, which is not suitable to the present equipment.

Sleighs are used in Canada to convey field ordnance during winter—three sleighs being required to carry the gun and its supply of ammunition. No special sleighs have been provided for the M. L. R. field ordnance. A few 12 pr. B. L. R. gun sleighs, left behind by the Imperial troops, have been utilized for the above purpose, by altering the brackets, cap squares and elevating screw gear. The alterations of these, as well as of a number of O. P. ammunition wagons, were carried out with a small expense to Government in the "B" Battery work-shops, which have been established, and are maintained notwithstanding great difficulties due to a very small establishment already burdened with excessive Garrison, Instructional and other duties, and to a stinted allowance in money for purchasing raw material, &c.

It is stated in the Hand-Book for Field Service, page 56, that on an emergency, summer carriages could be secured on sleighs, but like all makeshifts the arrangement would not perhaps be very efficient.

Though the gun and carriage of 16 pr. batteries weigh 42 cwt., still those batteries are provided with only 6 horses per gun—the total of horses being 74 draught, stronger and heavier than the ordinary type of artillery horses.

MOUNTAIN BATTERIES.—Though the proper establishment and the equipment of mountain batteries have not yet been decided upon in the British service, still, armaments and equipments were several times laid down for them, and some batteries have been temporarily

organized, one battery for Abyssinia was armed with 7 pr. M. L. R. steel guns. (1)

The steel 7 pr. M. L. R. of 150 lbs., is at present the mountain gun of the British service. (2)

A battery of 7 pr. bronze mountain guns was provided for the Red River expedition of 1870, temporary carriages having been made in addition to the ordinary ones to allow the guns being used for boat service on the water route. Four of those guns were subsequently issued to the [late] Beauce Battery of Artillery, Province of Quebec, and limbers provided for them. They formed a very efficient battery which could take position in the most rugged *terrain*, specially when horsed with the small hardy horses of the lower section of the St. Lawrence.

3. **AMMUNITION.**—The grand total of ammunition to be provided for Field Artillery is laid down at 600 rounds per gun, (3) transported and apportioned as follows:—

1st. The ammunition contained in the limbers, ammunition wagons and general service wagons of batteries;

2nd. That, carried in the divisional reserve column, [1st reserve];

3rd. Such ammunition as is carried in the corps ammunition reserve column, [2nd reserve];

4th. The supply in charge of the controller and put in the Field arsenal, [3rd reserve];

5th. And finally the quantity contained in the grand depot, at the base of operations and intermediate reserve.

The ammunition to be brought up by batteries in the field is: for the 9 pr. 300 rounds, and for the 16 pr. 280 rounds.

The proportions of the different projectiles of the supply carried with the batteries are:—

	9 pr.	16 pr.
Case shot.....	4	4
Common shell.....	48	34
Shrapnel "	96	62

(1) Owen's Modern Artillery, page 888.

(2) Griffith's Artillerist's Manual, page 65.

(3) Wolseley's Soldier's Pocket-Book, page 58.

The above proportions apply also to the remainder of the ammunition.

Batteries of 40 pr. M. L. R. guns take into the field a total of 160 rounds, which divided between the four guns of a battery give 40 rounds per gun.

The expenditure of gun ammunition in different battles of the war of 1870, varied considerably, the lowest average being $14\frac{1}{2}$ rounds per gun, and the highest 126 rounds per gun, per engagement. (1)

The French Artillery was provided in 1st line with 400 rounds per gun, and the Prussian Artillery with 277 rounds for the 4 pr. [equal to our 9 pr.,] and 251 rounds for the 6 pr. (2)

Reference is made for a detail of stores, &c., of the 9 and 16 pr. batteries, to Griffith's Artillerist's Manual, pages 82 and 86.

Section 4. SMALL ARMS AND AMMUNITION.—The supply of small arms and ammunition will now be referred to.

The Canadian Militia is at present armed with the Snider-Enfield rifle of .577 inch bore, number of grooves 3, spiral one turn in 6.5 feet.

Both long and short rifles have been issued to Infantry and Garrison Artillery corps.

The Snider-Enfield is the Enfield rifle musket adopted in 1853, and subsequently converted into a breech-loader. The advantages gained by the adoption of the breech-loading system are, among others, ease and rapidity of loading, and consequent rapidity of fire. It has been found from careful experiments, that the converted Enfield may be loaded and fired with good aim at the rate of 10 shots in 1 minute 44 seconds; the average time of the Enfield which it replaced, was 10 shots in 4 minutes, 46 seconds, the conversion thus quadrupled the firing capacity of the weapon without affecting its accuracy or range.

Though the Snider-Enfield has been superseded by the Martini-Henry rifle, the small bore of which renders its projectile less liable to be affected by the resistance of the air, and gives it a flatter trajectory, still the Snider is a sufficiently accurate and far-ranging weapon for the ordinary circumstances of war-fare, at useful ranges. Some corps *d'élite* armed with a long ranging rifle as the Martini-

(1) Owen's Modern Artillery, page 382.

(2) Fave, *L'armée Française depuis la Guerre*, page 50.

Henry, would undoubtedly in certain occasions be useful, but in the Franco-Prussian war the highly trained Prussian soldier with the inferior needle gun, proved himself to be more than a match for the French infantry man armed with the far ranging *chassepot*. The Snider-Enfield, moreover, is much cheaper than the Martini-Henry. (1)

There is certainly some disadvantage in having a different ammunition to that of the Imperial troops, and the same reasons adduced above in favor of similarity in this respect, hold good for Infantry as for Artillery armament. Reference is made, on this subject, to the report of the Major General Commanding the Canadian Militia, (2) by which it appears that 80,000 stand of arms are already in possession, and that it is impossible under the circumstances of a stinted militia vote, to attempt a re-armament.

The Snider cartridge is made of thin sheet brass lapped over and covered with paper, the base is of metal, with a cap in the centre, the bullet lubricated weighs 530 grains, the charge of powder is $2\frac{1}{2}$ drachms.

The proportions of cartridges per man, taken into the field in the British army, are as follows: (3)

Infantry, 1000; Cavalry, 500; other corps, 250, distributed thus:

	Infantry.	Cavalry.	Artillery and other corps.
In possession of troops.....70	100	20	20
Regimental reserve.....30			
Field reserve with } 1st. res. 40	80	10	10
Artillery } 2nd. res. 40			
Control reserve & } Field arsenal ... } 3rd. res.	50	20	25
	230	50	55
Control reserve grand depot and intermediate reserve. }	770	450	195
Total.....1,000	500	250	

(1) Priced Vocabulary of Stores, 1875, page 21 and 35.

(2) Militia Report, 1875, page XVII.

(3) Wolseley's Pocket-Book, page 51 and 52.

The quantity of ammunition now in possession of the Canadian Militia does not it appears, exceed 150 rounds per stand of arms; a quite too limited supply.

L'arme blanche can no more replace infantry fire in action, deficiency of ammunition means defeat or forced retreat.

The French, taught by disaster, have laid down strict regulations and a special drill to impress on the minds of their infantry the value of ammunition; so direful has been for them the result of deficiency in that respect. Each man during a drill parade is questioned at different periods after firing, as to the number of rounds remaining in his knapsack, pouch, &c. (1)

The Regimental reserve is carried in carts permanently attached to regiments. The new pattern ammunition carts will carry 28,800 rounds of Martini-Henry, or 26,880 of Snider-Enfield ammunition.

The first and second field reserves of small arm ammunition are in charge of the Artillery. The officers commanding the batteries to which the wagons containing the first reserve are attached, requisition direct from the officers in charge of the second reserve, who, in their turn, requisition to complete from the third reserve in charge of the controller.

The first reserve conveyed in S. A. ammunition wagons, attached to the Field Batteries, is under all circumstances to be at hand so that no delay shall arise in issuing to corps who's supplies are exhausted. This first reserve is under the control of the Divisional Commanding officer of Artillery. The second reserve conveyed by the Artillery, in service wagons or in other vehicles as circumstances require, is always to be up with the army, but kept as far as practicable from under fire. This reserve is also under the control of the Divisional Commanding Officer of Artillery.

Before issuing the boxes containing S. A. ammunition to the 2nd reserve; the screws securing the lids of the ammunition boxes are to be removed in the presence of the Artillery officer or N. C. officer, to whom the boxes are to be delivered.

The third reserve, in charge of the Control Department, should not be more than two days march in rear of the army, and may be advanced at the discretion of the Commander of the Forces.

(1) No: 412-414, Instruction du Soldat Reglement du 12 Juin, 1875.

The grand depot should not be more than two marches in rear of the second reserve, and if it is necessary to establish the depot farther to the rear, then intermediate depots are to be formed.

II.

MODES OF SUPPLY, CARE AND REPAIR.

Having attempted so far to determine the Artillery matériel, the Small Arms and small arm Ammunition required by our Canadian Militia; the modes of supply, care and repair of the above will now be treated.

Section 1.—Our sources of supply.

Taking for granted that the armament and equipment of the Imperial service, are the standards that guide us in providing the Canadian Militia; from what sources of supply will be derived the Artillery material, &c., required.—

Governments supply themselves with war matériel, by manufacturing or purchasing.

Manufacture is carried on by the State, or, under the control of the State, by private parties for the State.

Purchases are made from private parties in the State, or from foreign [government or private] manufacturing establishments.

In England, manufacture is carried on almost entirely by the State, at the Royal gun or other factories, as regards Artillery armament and equipment, also, small arm ammunition, and [at Enfield] small arms. (1)

In France, prevails a combined system of manufacture, by the State, and by private parties for the State, under its control. Thus, the manufacture of iron and steel for the construction of war matériel, with the manufacture of projectiles, are carried on by private firms, controlled by Artillery Officers. The manufacture of rifles, *armes blanches* and other arms, under the head of *armes portatives*, is carried on by contract; the contractor signing contracts for 15 and 20 years, the prices being re-arranged during the term, to suit new conditions of manufacture. (2)

(1) Sir William Armstrong and Birmingham factories have been employed on Government Armaments, under the supervision of Artillery Officers.

(2) Vauchelle, Cours d'administration Militaire, Vol. I, pages 208-215.

Powders are manufactured by the State; also guns for garrison and other branches of the service. (1)

Carriages and Artillery Equipments are manufactured by the State in Artillery arsenals, properly called *arsenaux de construction*. (2)

Turkey, Egypt, Italy, Denmark, the South American Republics and Japan, have purchased guns from Sir W. Armstrong, & Co., Elswick. (3)

Prussia is supplied with ordnance by the great firm of Herr Krupp, who's extensive works had already in 1867 turned out 3,500 guns.

Russia has been supplied from the same source, though it has also its own manufacturing establishments. (4)

The United States have been supplied with Artillery matériel by contractors under the control of the *Ordnance corps*, composed of officials, who, though possessed of high theoretical qualifications, lack the practical knowledge that comes of serving in the field with the weapons they are called upon to modify or construct. "Cannon for the United States are made by private founders, the material and product are under the supervision of an Ordnance Officer, who receives the piece only when it has satisfied all the conditions imposed by the regulations of the service." (5)

The proof of United States ordnance is carried on under the supervision of the ordnance corps, as follows:

Guns, Howitzers and Columbiads, are fired three times with solid shot, and a charge of powder somewhat greater than the service charge. (6)

This mode of proving ordnance, seems superficial, when compared with that of proving British ordnance, "steel tubes for heavy guns, are now subjected after toughening, to a water pressure in the interior of 8000 lbs. per square inch which is sufficient it is thought, to detect any latent cracks." (7)

(1) Vauchelle, Vol. I, page 221.

(2) Vauchelle, vol. I, page 201.

(3) Foot note, page 4, Text-Book, Construction of Rifled Ordnance.

(4) Owen's Modern Artillery, appendix. Text-Book, Construction Ordnance, page 27.

(5) Benton, Ordnance and Gunnery of the United States.

(6) Benton, cited, page 206.

(7) Text-Book, Construction of Rifled Ordnance, page 19.

All guns are minutely examined before proof, and gutta-percha impressions taken of the whole length of the bore; two rounds of $1\frac{1}{4}$ the highest service [battering] charge with a service projectile, are then fired, after proof the guns are tested by water pressure in the bore, of 120 lbs. on the square inch. Gutta-percha impressions are again taken, and if any defect should then appear of which there is the slightest doubt, the gun is subjected to five more rounds with service charges; if after that, the defect does not appear to have increased, the gun is passed. (1)

The Canadian Militia, as an auxiliary force, for reasons already given, should adopt an armament similar to that of the main force with which it is intended to operate. To ensure this similarity, the process of manufacture of the ordnance to be obtained must not essentially differ.

Making guns similar to those of the British army, necessitates a costly, special and extensive plant. (2)

With our means and present demands, the manufacture of wrought-iron ordnance cannot in Canada be successfully undertaken. War matériel, no more than other manufactured objects, is produced cheaply, in small quantities; therefore the outlay to make the relatively few guns, &c., required, would tend to increase the cost thereof, in an enormous ratio.

Cast-iron Rifled Ordnance, could be more easily and cheaply made, not wanting the long and difficult process that attend the manufacture of wrought-iron guns, but it is thought at the expense of real efficiency: Firstly, because similarity with the Imperial equipments, would thereby be sacrificed with consequent serious disadvantages; Secondly, because cast iron ordnance has proved to be unreliable.

Numerous instances of the uncertainty of cast iron, or even cast steel ordnance are on record.

"In the attack on Fort Fisher all the Parrot guns [cast iron hooped rifled] in the fleet burst. By the bursting of these guns at the first bombardment, 45 persons were killed and wounded."—[Report on Ordnance, United States Senate, 25th February, 1869. (3)]

(1) Text-Book, Construct. Ordnance, page 112.

(2) Text-Book, Construct. Ordnance, chapter 2.

(3) Text-Book, cited, foot note, page 27.

"In 1868 an 8 in. Krupp gun [cast steel] burst on board a Russian frigate, very destructively; killing and wounding in all 12 men." (1)

Cast iron rifled guns, hooped, are used in France, they are fired with charges of slow burning powder, and considerable windage is given to reduce the strain; low initial velocity and high trajectory are the results.

Rodman guns [S. B. cast iron] in the United States are not to be fired with battering charges except on service. Officers of the United States Artillery have stated that these guns were not to be trusted when fired with battering charges. They are, however, being rapidly converted into trustworthy rifles, by the insertion of wrought-iron tubes on Sir W. Palliser's principle.

Bronze, formerly used in the construction of guns, has now been generally abandoned—the metal being soft, wears out quickly, producing inaccuracy, but an Austrian process of casting bronze is said to be successful. (2)

"The main merit of our guns [wrought-iron rifled] is their non-liability to burst explosively, and that if a gun fails at all it will, in all probability, give timely warning to the gun detachment." (3)

The effect produced on gun detachments manning inferior ordnance is most undesirable, when, confined in gun pits or casemates, the men feel that not only are they exposed to the enemy's projectiles, but to be destroyed at every round, by their own guns.

Thus, wrought-iron ordnance should be adopted, concurrently perhaps to an extent with cast iron S. B. guns, converted on the Palliser principle, into rifled ordnance, by means of a lining of coiled wrought-iron, grooved. None of the latter guns are intended to be used as battering guns. Experiment has proved, however, that: "These 64 pr. rifles are perfect guns for defensive purposes. They are much more powerful than the 64 pr. Krupp guns in the siege of Paris; Firstly, because the shell contains 6 lbs. [7 lb. 2 oz?] of powder against 4 lbs.; Secondly, because the powder charge for the gun can be increased with perfect safety, to 14 lbs., when the gun ranges with ease 8,000 yards."

(1) Idem, page 28.

(2) Strange, Artillery Retrospect, page 11.

(3) Text Book, Construction of Rifled Ordnance, foot note, page 26.

"The Ordnance Select Committee in England, tested a converted 64 pr. against two Woolwich, or built-up guns. The first of the latter burst into 38 pieces with great violence at the 2,270th round. The second Woolwich gun burst into two pieces at the 2,211th round. The Palliser gun fired 2,280 rounds, when the Ordnance Select Committee ordered the firing to stop."

"The first twenty-four rounds, fired from this gun, were with 16 lbs. powder and 86 lbs. Palliser shot, at Shoeburyness, where it penetrated the Warrior target. (1) The last 100 rounds were fired with 14 lbs. charges and 64 lbs shell, a tremendous ordeal."

As to the alternative of obtaining supplies by contract with private firms, manufacturing for the State, under its control, none of the requisites to favor the adoption of this mode of supply, are to be found in Canada, except, perhaps, for the conversion of our stock of old iron S. B. guns into rifles on the Palliser principle, provided the manufacture is watched and the proof conducted by an Artillery Officer.

Large manufacturing establishments, capable of adapting their plant, to the construction of wrought-iron ordnance, could perhaps be induced to do so, if as already submitted, our demand was likely to be considerable, but not it is believed, under the present circumstances, at least, not at economical conditions, moreover, to control operations, Artillery Officers of great practical ability, and technical knowledge, would be required.

Experience has often pointed out the disadvantages of employing private firms for the above purpose.

"Le 3 Décembre, les premières pièces de 7, fabriquées par l'industrie privée, furent livrées.

* * * La première visite montra que les rayures n'avaient pas été polies, &c.

"Trois canons sur quatre présentèrent des fissures dans la chambre, au quatrième coup.

"Ces observations portaient sur des défauts d'ajustage, dont les ingénieurs n'avaient pas primitivement compris l'importance, &c. (2)

(1) 4½ inch iron plate on an 18 inch teak backing, and with a ½ inch iron skin.

(2) Ducrot, *Siege de Paris*, 1870, page 147.

Sir W. Armstrong & Co., and other private manufacturing establishments in England, have it is true, succeeded in making good ordnance, but they had special advantages in being assisted by retired Artillery officers of great merit, and guided by official experiments, costly and of the most searching kind. They were, moreover, fostered by large orders from Government, and benefited by military experience acquired on service or otherwise.

And finally, if, to supply ourselves, instead of taking advantage of the Royal Gun and other factories in England, opened to Canada as a purchaser, we preferred dealing with foreign manufacturers, it would only be discarding British guns adopted in the Imperial service, proved by experiments and competitive trials with the best guns of foreign manufacture, to be not inferior in power, range, accuracy, and superior in all other respects. (1)

The above apply equally to the modes of supplying small arms.

The number of rifles on hand is given to be 80,000 stand of Snider-Enfield, (2) 50,000 of which are in possession of Militia corps.

It has been expressed by high military authority, that it would be undesirable to increase the number on hand, in view of a future re-armament with Martini-Henry rifles. No increase that would produce a mixture of the two rifles is advisable, as it involves the use of two kinds of cartridges. For the same reason, a change in armament should, when decided upon, be complete and uninterrupted. (3)

If conditions are adverse to the manufacture of small arms in this country, not so with their ammunition; it has already been recommended by Lt.-Col. Strange, R. A., Inspector of Artillery, and by Lt.-Col. French [late Inspector]; both advocated the inception of this manufacture, even if it was only on a small scale. It is worth considering even the advisability of collecting the shells of fired cartridges with a view to the experiment of refilling.

The relatively large expenditure of S. A. ammunition at target practice, &c., the low state of our reserve, 150 rounds per stand; added to the fact that the process of manufacture is not very com-

(1) Precis of the Report of Col. Berge, of the French Artillery, translated, W. E. M. Reilly, C. B., R. A. Proceedings R. A. Institution, page 193, vol. VIII. English Guns and Foreign Critics, V. D. Majendie, R. A. Proceedings, vol. VII.

(2) Militia Reports, 1875, Major-General Commanding, page xvii.

(3) Idem, page xvii.

plicated and allows unskilled and cheap labor to be employed, should be sufficient reasons to act upon the above recommendations.

Powder of certain grades could, perhaps, be made in powder mills of the country. It would undoubtedly be advantageous to have it in our power to supplement ordinary supplies of a substance, the transport of which from England might be delayed by adventitious circumstance, and cause serious complications.

The following tests would in that case have to be made :

On the charcoal used to see that it is free from sand, and an excessive quantity of ashes, that it is thoroughly carbonized ;

On the sulphur to ascertain that it is free from sand and other impurity :

On the saltpetre^{re} to identify it and to test its purity, to test if it contains chlorides, lime, sulphates, nitrite of potassa.

The chemical analysis of the gun powder produced might also be performed apart of the above tests.

The manufacture of a certain class of projectiles, viz: chilled shot and common shell for heavy guns, could be attempted; a good iron for the purpose is obtained in the country. The Radnor and St. Maurice iron deposits have been utilized, in the manufacture of chilled iron R. R. car wheels that have given satisfaction.

In 1775, our neighbours used this iron for casting projectiles, to batter the walls of Québec. (1)

War matériel and stores of certain descriptions, are manufactured in India, the same military reasons, viz: distance from the sources of supply, render this course advisable in Canada.

Carriages, gun stores and a variety of other matériel in the construction of which wood the staple produce of the country enters largely, could also be advantageously manufactured here. Under all circumstances, the control and supervision of their manufacture should be exercised by officers possessed of sound technical knowledge. A commencement might be made in the work-shops of "A" and "B" Batteries; using the iron work of old unserviceable carriages.

(1) Journal de Bédard, page 83. Literary and Historical Society, Quebec, 3rd series. Historical Documents.

Section 2.—Intimately connected with our subject is that of
Arsenals.

They are of the 1st. class, if established for purposes of construction and repairs, storage, distribution of war matériel.

Of the 2nd class, if their operations are confined to repairing, storing and distributing.

And of the 3rd class, if for storing and distribution only.

To whatever class they belong, their first qualification should be security against attack as far as consistent with a second, their situation being such as to render transport to and from them, and distribution, as efficient as possible. The proper balance of those essentials is the main point in the establishment of an arsenal. Proximity to sources of supply of raw material and skilled labour, should also be considered, specially in the case of a 1st. class arsenal.

The topography of the country and the site chosen may give security, and a well devised system of fortification add thereto.

To facilitate its operations, an arsenal must be placed in a central position relatively to that part of the country it is intended to supply; at the meeting point of great arteries of communication.

Arsenals were formerly established on the frontiers of States. Traffic was then slow and difficult, and though railways have not done away with intermediate depots, still great arsenals may now be placed in more remote positions, transport being carried on by rail and water with sufficient facility, while additional security is obtained in placing them out of the enemy's immediate reach.

The opinions of military writers in England, have, for some time, been strongly expressed in that sense, with regard to Woolwich.

"The magazines were in the front line of danger." [Alluding to the French arsenals in 1870.] (1)

As a consequence, when Metz and Strasburg surrendered to the enemy, the French armies were thereby deprived of large quantities of war matériel, and of other means, to protract the defence of the territory.

The *personnel* of an arsenal may consist of a director or superintendent, a sub-director or assistant-superintendent, and of a certain

(1) Staff College, Prize Essay, 1870. Lt. G. H. H. Collen.

number of officers, employees and artificers to carry on the administration and the work of the arsenal. (1)

The director would see that all orders are fulfilled that come from the director of Artillery stores, who would, in turn, receive his orders from the Secretary of State for War or other superior authority. The director of the arsenal, assisted by the sub-director, would see that each officer or employee does his duty. He would have the same authority over the *personnel* of the establishment as commanders of corps have, to enforce discipline and order, to impart instruction and insure efficiency.

Under his orders the sub-director would supervise and direct all work, dividing it between the different classes and squads of artificers.

The sub-director would also be present at the reception of raw materials and superintend their storage and employment, seeing that strict accounts thereof are kept. He would be responsible that disciplinary and other regulations are strictly adhered to.

The officers employed at the arsenal, and under them the chiefs or conductors, the sub-chiefs or sub-conductors, and the artificers, carry out the "service" of the arsenal, divided under four heads:—

1. Approvisioning. 2. Constructing.
3. Administering. 4. Instructing.

Under the first head: Firstly, the reception, storing and care of woods, iron and other metals, coals, tools, and other articles necessary for the construction and repair of war matériel. Secondly, the distribution of these materials.

The construction would be exclusively entrusted to the corps of artificers. The officers commanding these artificers would have the supervision of the construction, assisted therein by their subalterns and heads of workshops. They would also have to test the quality of the raw material provided for the work, and be responsible that the articles manufactured are according to pattern and not faulty in construction or fitting. (2)

The officers in charge of the artificers, keep correct account of all matters by which they incur responsibility. The approvisioning

(1) Vauchelle, Cours d'administration Militaire, Vol. I, page 202.

(2) Vauchelle, vol. I, pages 105, 208 and 207.

in raw material, is done by calling for tenders, or by contracts, which are in all cases to be submitted to the Minister of War before final approval.

The accounts of an arsenal, are based upon the annual inventories and stock taking, the store ledgers and other records of receipt issue and expenditure, of the different branches of the administration. The audit of those accounts is made by officials appointed under the authority of the Minister of War and in the War Department. (1)

Lieut. E. H. M. Collen, R. A., in a lecture entitled, "Military Transport and Supply in India," read at the United Service Institution in 1870, has dealt with the subject of arsenals in India, as follows:—In India, arsenals are controlled by an Ordnance Department. That department has charge of all warlike and military stores including small arms, material for their repair, tools, engineers stores, harness, saddlery, accoutrements, camp equipage, &c., in fact all the equipments and military stores required for an army.

In addition, the Department has charge of all kinds of raw material required for military purposes.

In each Presidency in India, there is a District Ordnance Department with an Inspector General of Ordnance at its head. He is the administering chief and adviser of Government, and the Commander-in-Chief, on all questions of war material; he resides at the seat of Government.

Subordinate to him are: the Deputy Inspector General and Commissaries of Ordnance, and subordinate to those, are Warrant Officers styled Commissioners, Deputy, and Deputy Assistant Commissioners, Conductors and Sub-Conductors, and further the non-commissioned class or sergeants.

The remainder of the Ordnance Department *personnel*, consists of clerks, artificers and labourers.

The commissioned officers or commissaries, are drawn exclusively from the Artillery. They have to pass an examination in technical knowledge, and the conduct of the business of an arsenal before being definitely appointed.—This very rational and proper course, of choosing Artillery officers for the above duties, is not being followed in the British service proper. (2) "Sir W. Mansfield

(1) Vauchelle, vol. I, page 205.

(2) Since this essay was in manuscript the control system was found so cumbersome and expensive a failure that it has been abandoned by Great Britain, but *facilis descensus*, not so easy to rise again; vested interests in an insane system will make it difficult to return to one of common sense.

calls the British control a system of uneducating generals, and I would add, Artillery officers, who are scientifically and practically instructed in the manufacture, care and repair of war material, and yet you take from them the most important part of their duties, to be handed over to civilians." (1) Control officers themselves, complain of being intrusted with duties they are not qualified to perform. (2)

Lord Strathnairn's committee, pronounced themselves most emphatically in favour of entrusting the care and repair of war material, to " Artillery officers who receive a special education which particularly suits them for this service."

—In Indian arsenals, the Warrant officers are appointed from the non-commissioned ranks, which can be recruited from all branches of the service, the merits of the candidates being determined by examinations. Those selected, are attached to the arsenal, instructed in their work, and if found qualified, permanently appointed.

A Deputy Inspector General is at the head of the Ordnance office of each Presidency; he administrates therein the interior economy of the Department, and supervises the check and passing of all requisitions for stores; he is assisted in his duties by a commissioned officer.

The Commissaries of Ordnance are in charge of arsenals; they comply with requisitions sent by divisions, corps or detachments, through the Deputy Inspector General, or, if of an emergent nature directed to them; for the commissaries have in that case also to comply, pointing out at the same time the regulations on the subject of unauthorized supplies.—

Without this last proviso, an army may become the " organisation of defeat," as in France for instance, in 1870, where: " The military business of the country was centered at Paris, for every work, a ministerial order was necessary, and the wise remark of Marshal Bugeaud was neglected or unheeded.—*On perd de vue dans la paix, les exigences de la guerre, et on fait des armées pour la paix.*"

—In India the requisitions are complied with, either by issuing from the stock in store, or by manufacture. The stores are replenished by orders from England, through the Indian office and the Indian Store

(1) Strange, Artillery Retrospect, page 2 foot note.

(2) "The Control service" by E. B. de Fonblanque lecture at R. A. Institute, 1870. Vol. XVI. R. A. Inst. proceedings, page 118.

Department, or by manufacture, local purchase, or occasionally from other Departments.

Arsenals in India, are of all classes, they are designated as arsenals proper, magazines and depots; they are all in charge of Artillery officers, and under the control as already said, of Inspectors General of Ordnance. Arsenals of the 1st class and to an extent those of the 2nd, consist of issue and receipt departments, pattern rooms, armouries and armoury workshops, harness and saddlery stores, accoutrements stores, foundries, tools, tent, raw and unserviceable material stores.

The *Park* contains the siege trains and Artillery heavy matériel, laboratory, magazines and workshops.

The 3rd class arsenals are mainly for storing, having no workshops attached, and containing those articles only most required by the troops.—

It is submitted that the above organisation, would in some measure be suitable to the requirements of Canada. The business of the Indian arsenals would in Canada, for reasons above adduced, be confined to the manufacture of such material, as could be economically constructed in the country, and to the care and repair of Artillery material and small arms.

As Arsenals of the second class, they would be provided with the necessary *personnel* and workshops to carry on the repair of guns, small arms, of guns carriages, harness and war material generally.

Laboratories would have to be established there to prepare cartridges, both cannon and small arm and other laboratory stores, also large magazines of proper construction and disposition to store explosives with safety.

Two principal points are attended to in connection with the storage of gun powder.

A. Place the magazine, so, that in the event of an accident occurring, the effect will be limited to the magazine.

B. Construct it and conduct the storage therein, so that the risk of an accident be reduced to a minimum.

To meet the first requisite, a site is selected remote from dwellings, roads, rivers, railroads, canals and public thoroughfares generally or if near such, then screens or mounds of earth are erected around the magazine.

Powder magazines should not be placed at less than 1,000 yards from inhabited localities. (1)

To meet the second, observance of precaution must be enforced, to guard against two classes of risks to which magazines are exposed, viz:—

1st. Risks from without;

2nd. Risks from within.

From without: Adjacent conflagrations or explosions, sparks sometimes carried from a distance.

Wilful incendiarism; lightning.

Risks from within: Fire from matches, lighted candles, pipes, breech-loading rifle cartridges, percussion caps, fuzes, fulminates, &c.

Fire from spontaneous combustion of oiled rags, cotton waste, chemical substances, &c.

Fire from sparks struck from iron or steel.

In fact, heat may be developed sufficiently by percussion or friction to cause ignition without sparks or flame appearing. Soft surfaces being the most effective preventative against this class of risks, magazines should properly always be lined and floored with wood. No grit should be allowed to penetrate into the magazines, and no barrels opened there, in any case, with nothing but wooden or gun metal implements; even friction of wood against wood is dangerous, if violent. Regulations exist for guidance in the removal of fuzes and emptying of shells, and also for the performance of laboratory operations. (2)

The rules laid down for the ventilation of magazines, would have to be adhered to. (3) Observations with the wet and dry bulb thermometer, have given very favorable results in Quebec; they were inaugurated there by Lt.-Col. Strange, R. A., Dominion Inspector of Artillery, and have been carried on for several years.

Parks to place reserves of heavy guns, would have to be formed.

(1) *Plain Hints, &c.*, by Major Majendie, R. A., for the Storage of Gunpowder, &c., prepared by order of the Home Secretary, 1874; 20th edition, page 5. Orders in Council, [Great Britain] from 1 to 9 Explosives Act, 1875.

(2) *Notes on Ammunition*, 1873, page 127.

(3) *Notes on ammunition*, page 112.

Great attention must be paid to the preservation of iron ordnance when in dépôt or on service, to prevent the irreparable injury guns sustain from rust and corrosion. As a general rule, guns when mounted require lacquering and painting every two years, and if on sea fronts every year. For this operation the first step to be taken is to scrape the rust and dirt from the bores and exterior of the guns with special instruments, then lacquer the inside, and give a coat of Pulford's magnetic paint to the outside. The recesses of sights, &c., are plugged with tallow and tow, and the fittings, if bronzed or blued, not burnished but oiled.

Guns on service would require to be examined as follows:—

9 inch and heavier natures after every 50 rounds, 8 inch and 7 inch after every 100 rounds, 64 pr. and smaller guns after every 150 rounds; defects, if any, and also the sentence should be recorded in a regular register of examination. (1)

Artillery projectiles are piled if possible under cover on dry and firm ground slightly elevated above the general level; a good base, if such does not exist naturally, would have to be formed with small stones, sand, &c., and overlaid with unserviceable projectiles. When exposed to bad weather they should be lacquered; coal tar is used for that purpose in the United States and in France. (2)

With projectiles for rifled guns, great care should be taken not to dent the soft metal coating or studs, which must be tapped or filed smooth when dented. This is particularly important with M. L. R. projectiles, as, when their studs are damaged, they are likely to jam in the bore in being rammed home, causing delay and much inconvenience, at the best.

Stores are required to put perishable articles, spare gun carriages, fittings, &c., and small stores of all kinds under cover.

Militia Field Batteries keep on charge their service equipment, as far as completed, they are often deficient of very important portions of it. A limited Reserve, not only of ammunition, but of other material might be obtained and kept in store for an emergency. A lost or damaged tangent scale, if none other is at hand to replace it, impairs the efficiency of a gun, the same can be said for other stores.

(1) Text-Book, Construction of Rifled Ordnance, pages 113 and 178, &c.

(2) Extrait du cours special, à l'usage des pelotons d'instruction des regiment d'artillerie, 1872, page 23.

A hand to mouth policy in this respect can not tend to the good of the service.

The following return of damages, sustained in a single action, by the German Artillery, in 1870, though they were opposed by an inferior adversary, points out the necessity of having reserves.

- | | |
|--------------------------------|--------------------------------------|
| 1st. Bat'y, [Heavy] III corps, | a gun wheel. |
| 2nd. " " " | center limber box. |
| 2nd. " [Light] " | several poles and lid of limber box. |
| 4th. " " " | 2 gun wheels and elevating screw. |
| 2nd. Horse Art'y. Bt'y., | a limber box shell passed through. |
| 1st. Light Battery, X corps, | a limber and gun wheel. |
| 2nd. " " " | a gun wheel and gun carriage. (1) |

Even during peace, deficiencies due to neglect or inexperience are constantly occurring in Militia Batteries, and cannot be made good without importing across the Atlantic after months, perhaps years of delay, some trifling part of the equipment which nevertheless renders useless a gun, a battery, or perhaps the whole armament of a fortress.

Transport carriages would also have to be put under cover and proper care.

This subject as well as the examination and repair of Artillery carriages, platforms, &c., have been comprehensively treated by Major L. Griffiths, R. A., (2) reference is made to his work.

Small arms when in reserve are kept in armouries provided with racks into which the rifles are placed, kept well oiled and often cleaned. S. A. armouries should be dry and each stand of arms therein easily reached by the care takers, to ascertain its state and keep it in order.

The care of arms, *i. e.*, those in possession of Militia corps has often left much to be desired. (3)

The military organization of the country is unfavourable to the enforcement of regulations tending to make each Militia man responsible for the care of his own weapon. The short annual trainings

(1) Hollist's German Artillery, campaign 1870, page 358.

(2) Griffith's Artillerist's Manual, 11th Edit., page 266

(3) Report of the Major-General in command, 1874, page xi.

afford no opportunities of imparting to the rank and file a knowledge of the rules laid down for that purpose in the "Musketry Instruction."

The practical knowledge of those entrusted with the instruction of Militia Infantry in this and other duties is often insufficient.

Recommendations bearing on the subject of care of arms, have been made by the General Officer in command of the Militia. (1)

A reserve of 60,000 rifles has been recommended to be procured, the storage of this increase to the number already in possession would immediately necessitate large armouries which could not well be situated elsewhere than in arsenals, under military guard and protection.

Small arm ammunition, containing its own means of ignition, is under no pretence to be placed in ordinary powder magazines along with other ammunition, special magazines would have to be used.

A supply of, at least, 800 rounds per stand of arms, has been deemed necessary to meet the exigencies of the service. (2)

As it is intended to bring the number of rifles in Canada to a total of 120,000 stand, the supply of ammunition would consequently require to be proportionately increased, and considerable magazine space provided for the storage thereof.

The above supply, not leaving a single round in reserve, would still be inferior to the regulated quantity to be brought in the field, by about 200 rounds per stand.

In connection with magazines and stores, may be mentioned here, the different means provided in fortresses for sheltering, preserving and facilitating the supply of different descriptions of Artillery matériel:

1st. *Side arm store*, to contain side arms, tackle, blocks, bearers, buckets, wads, &c., for every eight guns or at the most twelve.

2nd. *Artillery small store*, to contain the stores [in use] for eight and at the most twelve guns.

3rd. *General Artillery store*, for the reception of the spare or general stores of 24 guns.

4th. *Expense shell store*, for every 2 or at the most 4 guns, with a lobby in which shells can be fuzeed if necessary.

(1) Report of the Major-General in command, 1874, pages xi and xii.

(2) Idem, page xii.

5th. *Expense magazine*, for the service of 4 guns, to contain 25 rounds per gun, and if not easily replenished at least 30 rounds per gun.

6th. *Main shell store*, for the purpose of storing loaded shells, from which they are conveyed to the *Expense shell store*, as required.

7th. *Shell filling rooms*, to be provided near each range of *main shell store*.

Main magazines with shifting rooms and cartridge filling rooms, separate from the magazines, but conveniently near them.

All these different dispositions are mostly applicable to heavy M. L. R. guns. The main points would be: as direct and well covered communications as circumstances admitted, between guns and expense magazines, the latter to be in the best situations, in point of security and ease of access. Main magazines should also possess the above advantages, the stores of powder sufficiently divided to render risks as small as practicable, and all doors and openings in the best direction to ensure the greatest possible security under fire. And finally the shell rooms and shell recesses must be easily accessible and well disposed for the rapid supply of loaded shells. (1)

Third class arsenals being only depots of stores, would, as a rule, contain but a limited quantity of war matériel, especially if exposed to attack, and in any case only sufficient to provide for the immediate wants of troops operating within their zone of supply.

These depots would be established at strategical points, and if in well chosen situations need not be numerous.

The organization and arrangement, except workshops, previously dwelt upon in connection with second class arsenals, apply also, but in a less degree, to those of the third class or depots.

Intermediate depots are formed during a campaign, in order that the supply to an army in its advance may be less precarious and exposed to the many contingencies of a long transit. The depots would generally be formed at the junction of important lines of railways, or other main lines of communication.

A large depot was formed in 1870 by the Germans at Rémilly, supplies were forwarded there from the great magazines on the

(1) Paper XI, Professional Papers R. E. [1871], vol. XIX.

Rhine. Two other depots were subsequently established near Metz, one at Courcelles, the other at Noveant. (1)

Field arsenals belong to the 3rd class, the storage would have to be improvised by utilizing such buildings as might be found on the site selected, or by constructing Field Magazines, &c. These arsenals are established out of range of Artillery, in the neighborhood of an invested fortress, to contain reserves of guns, ammunition, carriages, stores of all kinds, and in charge of the principal superintendent of stores, who has to keep up the supply by drawing from the depots in rear.

The Harbors of Kamiesch and Balacava were depots of the allied armies in front of Sebastopol. Supplies were stored there and afterwards brought up to the Field Arsenals and Batteries.

Section 3.—Location of our Arsenals and Depots.

Considering that it is more advantageous, both in a financial and military point of view, to maintain good and efficient arsenals at strategical points than to multiply those bases of supply, and thereby, the dangerous points to be protected; it may appear that two, at the most three, 2nd class arsenals should be established in Quebec, Ontario and the Maritime Provinces.

At present five military store depots of importance exist in Canada under Dominion control: at Quebec, Montreal, Kingston, Toronto and London.

The establishment of extensive permanent fortifications and ample storage at Quebec and Kingston significantly points out that they have been considered by the Imperial military authorities as two positions where means of defence should be concentrated. Though both have till now been—under Dominion control—depots only, conditions, political and others, having been altered, it may now appear that they should be organized as arsenals.

Montreal, by its central position, offers great facilities of supply [distribution], but its situation would perhaps be considered objectionable. "Convenience and security of the base, the position of the enemy's forces, the facility in the shape of good and practicable roads for reaching the object, the proximity of the object, the fitness of the topographical character of the theatre to

(1) Hamley's Operations of War, cited, page 40.

the army destined to operate in it," (1) are all considerations that govern in the selection of a theatre of war.

Those conditions would induce an invader from the South to attack Montreal. History points out to such a course. (2)

Montreal is therefore in a relatively exposed position to become a depot of considerable quantities of war matériel and means of construction and repair, such as are collected in 2nd class arsenals.

"Il serait imprudent d'accumuler trop de ressources pour alimenter la guerre, sur des points que l'ennemi peut dépasser de prime abord." (3)

Of what avail were to France the large constructing establishments of Metz after the investment of that fortress by the Germans?

Quebec does not perhaps offer the same facility for the distribution of supplies, as it is not in a central position, relatively to the densely populated parts of the two old Provinces of Canada. Moreover, if Montreal was invested the lines of communication between Quebec and Ontario would temporarily be blocked, and permanently so if Montreal surrendered; but, it may appear in further remarks that means could be adopted to palliate the effect of those events.

Still, if the main source of supply was England, and Great Britain maintained its present naval supremacy no more favorable situation for an arsenal might be found in the country. In fact, Quebec could become the general receiving arsenal or magazine, from whence supplies would be forwarded westward.

As time and distance are two great elements in warfare, when a country has depth of territory, arsenals can be placed far out of reach and are then proportionately secure; not so with our long, narrow belt of inhabited country; it may appear, however, that Quebec is a sufficiently secure strategic point for an arsenal, not only by the natural and artificial strength of its site and fortifications, but also by its topographic situation.

Serious attack can not, it is thought, be directed against it from the Maine frontier opposite; the country, on both sides of the line, is most unfavorable to military operations of importance. That portion of the State of Maine forming a salient north of the 45th

(1) Hamley's Operations of War, page 55.

(2) Preels of Wars in Canada, cited, page 86.

(3) Vergniaud, Art Militaire, page 119.

parallel, towards and opposite Quebec, averages less than two inhabitants per square mile, and is consequently uncleared. The Chaudiere River is shallow, full of rocks, perfectly unnavigable. There is no railway communication through the Maine frontier to Quebec, and the most northward railroad in that State passes on the south bank of the Penobscott River, at Lincoln.

The small area of cultivated land—hardly 40 acres per square mile—and the small returns of agricultural production, about \$450 per square mile, for more than half of Maine, indicate that intercourse and the consequent establishment of railway communication and other facilities of transport on that part of the frontier, are likely to be slow in their progress. (1)

Arnold's advance by the Kennebec route, in 1775, practically proved the unfeasible character of a scheme of invasion from that point of the frontier, and the conditions of the case have not been much altered since then.

An attack against Quebec, if confined to the south shore of the St. Lawrence would therefore have to be made from another direction,—perhaps the Lake Champlain line,—and could be met by a defensive force in several prepared positions—Sorel fortified and properly held would make the enterprise more hazardous. Isle-aux-Noix is already fortified, but without armament or garrison.

Quebec therefore by the nature of the frontier opposite would possess to an extent the advantages conferred by depth of territory, so desirable for prolonged defence, whilst it could provide its defensive force with abundant supplies of material of all descriptions, by water and by the Railways on both sides of the St. Lawrence.

It is true that if Montreal was captured, supplies could no longer be forwarded westward from Quebec; but the disastrous effect of that event might be palliated, by establishing at Ottawa one of the above mentioned second class arsenals. This scheme of locating at Ottawa a grand depot of war material, has been recommended by high military authority.

By its retired position, Ottawa is comparatively safe. Moreover, the chances of success of an attacking force directed against it, would be precarious, at least, as long as two strong holds, Kingston and Montreal [fortified] held out, engaged as the enemy would be

(1) Walker's Statistical Atlas of the United States, part II, 1874.

with forces having three important fortresses, available as pivots of operations. These advantages, and a well devised system of earth-works would make Ottawa suitable for the establishment of a large depot or second class arsenal. Its easy communication with Montreal by the Ottawa river, and the Montreal, Ottawa and Occidental R. R.; with Kingston by the Rideau Canal and to an extent the Prescott and Grand Trunk railways, and at a future date with the westward country by means of Railways now constructing or projected, would render the supply therefrom both easy and expeditious.

In fact, with such facilities of transport, the storage of material at Kingston could be reduced to a minimum and the stores not immediately wanted there, concentrated at Ottawa, the secure water communication by the Rideau Canal supplemented to an extent by railway, rendering the transport between the two cities, of even the heaviest material, a matter of no great difficulty; while in the event of naval inferiority on the Lakes, not enabling us to protect Kingston from bombardment and perhaps capture, a large quantity of stores would thus have been kept secure and available for further defensive operations.

London, Toronto and Montreal have at present storage capacities that could be utilized for the establishment of 3rd class arsenals or depots. London might perhaps not be considered secure in a sufficient degree for the purpose. Its position is considered by authorities as very much advanced, and it may be liable to be cut off at an early period of the campaign, moreover, it would require to be fortified, an expense that neither its strategical, commercial or political importance, perhaps at present warrant.

Toronto, exposed as it is to naval attack, would in any case have to be fortified, its importance rendering this course advisable, whilst, if superiority on the Lakes was secured, its retired position from the frontiers renders it suitable to become a depot to supply the forces entrusted with the defence of that section of the Dominion.

Montreal, though liable to attack, would nevertheless have to become a 3rd class arsenal, its strategical importance necessitates its being fortified, and this heavy but unavoidable expenditure, would be made to serve two purposes.

The investment of that city, if put in a proper state of defence, might be made a very arduous enterprise, situated as Montreal is, on an island formed by two wide and rapid rivers, difficult to bridge over.

The storage, &c., of war material for the force employed in its defence, necessitates at Montreal the establishment of a depot or 3rd class arsenal—utilizing for that purpose the buildings, shops, &c., already existing.

Halifax might perhaps become a 2nd class arsenal for the Militia of the Maritime Provinces, without its efficiency as a naval station being impaired thereby. Fredericton, though near the frontier, could be made sufficiently secure for a depot or 3rd class arsenal. St. John's, it has been said, when in a thorough state of defence will add materially to the security of Fredericton.

The importance of Vancouver Island as a station for the Imperial Navy in the Pacific—it is to be trusted—will secure to it, from proper quarters, adequate protection at no distant date. This, however, may not prevent the Dominion providing the Militia force of British Columbia with means of action to co-operate in the defence of the future terminus of our Canadian Pacific Railway. The necessary armament and equipment might be provided and stored up at Victoria or Esquimalt, where important dockyards and naval stores exist, and would have to be adequately protected by heavily armed and well garrisoned fortifications.

Thus, three 2nd class arsenals [including Halifax], might, it may appear, be advantageously established to supply, take care of and repair the warlike stores, and especially the Artillery material, small arms and ammunition required by the Canadian Militia, and four third class arsenals, viz., at Toronto, Kingston [naval], Montreal and Fredericton, the latter confining their operations to receiving, taking care of, and distributing the material supplied, making only such urgent repairs of damages thereto, as could be carried on with the limited *personnel* and material at hand.

In utilizing the existing military depots as arsenals of the 2nd or 3rd class, little more, it may appear, has to be done but re-establish therein, under Dominion control, a *personnel* and the materials withdrawn a few years ago by the Imperial authorities, and to an extent only, sufficient to meet the wants of our military organization.

The above remarks have therefore been made with the object of recalling to notice a mode of utilizing the means actually at hand in the shape of storage, buildings, workshops, &c., in a great measure as previously done under Imperial administration.

To conclude: with a proper, well cared for armament and equipment, and staunch hearts to utilize them in our defence; let it be said, "*Nil desperandum auspice deo.*" *

Fossambault, 28th July, 1877.

* B Battery motto.



